POLIOMYELITIS.

NOTES ON THE DISCUSSION AT THE FIFTEENTH INTERNATIONAL CONGRESS ON HYGIENE AND DEMOGRAPHY.

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The joint sessions of sections 1 and 5 of the Fifteenth International Congress on Hygiene and Demography, September 26, was devoted to a discussion of poliomyelitis, in which a number of those who have been most prominent in the investigation of the subject took part.

Addresses were presented by Dr. Axel Holst, of Norway; Dr. Karl Landsteiner, of Vienna; Dr. Simon Flexner, of the Rockefeller Institute for Medical Research; Dr. Alfred Pettersson, of the State Medical Institute of Sweden; Dr. M. J. Rosenau, of Harvard Medical School; Dr. Mark W. Richardson, secretary of the Massachusetts State Board of Health; and Dr. A. Neustädter, of New York.

In addition to the comprehensive discussion of the facts previously known regarding the etiology and epidemiology of poliomyelitis, some very important observations and experiments were presented for the first time in this country.

Experiments demonstrating the presence of the virus of poliomyelitis in the buccal and intestinal secretions of persons in the acute stage of the disease, convalescents, persons suffering from clinically obscure infections of poliomyelitis, and apparently quite healthy persons in the immediate vicinity of poliomyelitis patients were announced by Dr. Pettersson in his summary of the investigations of Kling, Wernstedt, and Pettersson at the State Medical Institute of Sweden in 1911 and 1912. A full report of these investigations, translated into English, was, through the generosity of the Swedish Medical Institute, distributed to all those present at the meeting. The following notes on the experiments of the Swedish investigators are abstracted from this report:[1]

Although the virus of poliomyelitis had already been demonstrated in the naso-pharyngeal mucosa and tonsils of monkeys and human beings infected with the disease prior to the work of Kling, Wernstedt, and Petterson, no one had been able to demonstrate the infectiousness of the secretions of the naso-pharynx or intestines.

In addition to the experiments previously reported,[2] in which they were able to demonstrate the infectiousness of the buccal, tracheal, and intestinal secretions of persons who had died of acute poliomyelitis, these authors now report further experiments showing the infectiousness of the buccal and intestinal secretions of living subjects.

To obtain the nasopharyngeal secretions, they washed out the mouth, nose, and pharynx of their subjects with physiological salt solution. To obtain the intestinal secretions, they washed out the rectum with salt solution introduced through a small tube passed up into the sigmoid flexure, the rectum having first been emptied of fecal matter by a large enema. The washings obtained by the above procedure were passed through a Heim filter, the pores of which were

[1] See also, for a summary of this report, Kling, C.; Wernstedt, W.; and Pettersson, A.: Zeitschrift f. Immunitätsfors. u. exper. Therapie, I Theil, Bd. xiv, Heft 3, Jena, August 28, 1912.

[2] Kling, C.; Wernstedt, W.; and Pettersson, A. Zeitschr. f. Immunitätsforch. u. exper. Therapie, Bd. xii, Jena, 1912.

found sufficiently small to remove the bacteria present while allowing the virus of poliomyelitis to pass through. The greater part of each filtrate (50 to 100 c. c.) was injected into the peritoneal cavity of a monkey, a smaller portion (not over 2 c. c.) being usually injected into the sciatic nerve of the same animal. The inoculated monkeys were kept under close observation, and of such as died or were killed careful post-mortem examinations were made, including histologic examination of the cord. In some instances the clinical and histological diagnosis of poliomyelitis was confirmed by inoculation of the spinal cord into other monkeys.

Monkeys were inoculated with the buccal and intestinal secretions of 11 persons suffering from poliomyelitis in the acute stage, including both severe and mild cases. In all but one of these cases the authors were able to demonstrate the infectiousness of either the buccal or intestinal secretions. Positive results were obtained with 7 out of 12 (58.3 per cent) specimens of buccal secretions and with 9 out of 10 (90 per cent) intestinal washings.

Experiments designed to show the persistence of the virus in the secretions of convalescents showed that in eight of the nine cases examined either the intestinal or the buccal secretions or both were still infectious more than four weeks after the onset of illness.

The secretions were found infectious in one case in the seventh month, in one case in the sixth month, in four cases in the fourth month, and in two in the fifth week after the onset of symptoms.

It would appear from these results that the virus of poliomyelitis quite commonly persists in the secretions of infected persons for more than a month after the beginning of illness, long after all acute symptoms have subsided. No observations were recorded on secretions obtained after an interval of more than seven months.

The authors still further report having demonstrated the presence of the virus in the mouth secretions of three persons who had not, so far as known, been in contact with any recognized case of poliomyelitis, but who had themselves suffered from rather slight illness, with no symptoms which could be considered at all characteristic of poliomyelitis. The authors point out that these persons are not hereby proven to have suffered abortive attacks of poliomyelitis but may have been carriers of the virus, suffering from some unrelated infection.

Finally, most important of all from the epidemiologic point of view is the report of these authors that they have demonstrated the virus of poliomyelitis in the buccal and intestinal discharges of persons who gave no history of recent illness but had been closely associated with other persons in their respective families suffering from typical poliomyelitis. Virus carriers were found in six families, namely: In each of two families, three; in one family, two; and in three, one each. The authors conclude that such carriers are most likely very common during epidemics of poliomyelitis, probably greatly exceeding the number of persons with clinically recognizable infections.

The interpretation of the results reported by Kling, Wernstedt, and Pettersson is, to some extent, dependent upon the acceptance of a type of experimental poliomyelitis (in monkeys) not recognized heretofore, namely, a type in which the clinical manifestations are sometimes characteristic, sometimes quite indefinite, and in which the infiltrated lesions of the spinal cord previously considered typical

of this infection were absent or slight, the chief histologic lesions found being degenerative changes of the motor neurons of the cord, neurophagia, changes in the glia cells, and sometimes hemorrhages into the substance of the cord. They bring forth, however, strong arguments to prove that such changes warrant their diagnoses of poliomyelitis.

These results, added to the previous observations of several investigators, that monkeys may be infected with poliomyelitis by placing the virus upon the uninjured nasal mucosa, or, under certain conditions, by feeding, together with numerous other observations upon experimental poliomyelitis, would appear to justify the conclusion that the infection is, in nature, disseminated by transfer of secretions directly from person to person, the lines of contact between recognized cases being obscured by the intervention of unrecognized abortive cases and apparently healthy carriers.

Doubtless this conclusion would be almost universally accepted but for the more recent observations of Dr. M. J. Rosenau, suggesting the agency of the stable fly (*Stomoxys calcitrans*) in the transmission of this disease.

As a result of the most careful and masterly epidemiological investigations of poliomyelitis conducted by the Massachusetts State Board of Health from 1907 to 1912, summarized by Dr. Mark W. Richardson in a paper presented at this meeting, it had been suspected that the *Stomoxys calcitrans* probably played an important part in the spread of poliomyelitis. Acting on this suggestion, Dr. Rosenau, collaborating with the Massachusetts State Board of Health, undertook some experiments which, though as yet incomplete, were formally reported at this meeting.

Dr. Rosenau announced that 6 out of 12 monkeys, exposed daily for several weeks to the bites of large numbers of *Stomoxys*, which were daily allowed during this time to bite several monkeys inoculated intracerebrally with poliomyelitis, had developed symptoms of this disease. Of these 6 monkeys, 2 had become paralyzed and died; 3 were sick, paretic, at the time of the report; and 1, after a short illness, had recovered.

Sections of the cord of one of the monkeys which had died showed lesions characteristic of poliomyelitis, while the cord of the other one showed degenerative changes which, however, in the absence of characteristic infiltration, were not considered sufficiently typical to warrant a diagnosis. Sufficient time had not as yet elapsed to determine the results of inoculation of the cord of the paralyzed monkeys into other monkeys and, pending the results of those inoculations, Dr. Rosenau reserved a final expression of opinion as to the diagnosis of the disease produced in these six monkeys.

This preliminary experiment, though not yet completed, is sufficiently striking in its results to direct the attention of all students of poliomyelitis to a further careful study of the *Stomoxys* as a carrier of this infection. Doubtless the concentrated experimental and epidemiologic study of the question from this point of view will soon throw upon it sufficient light to dispel the apparent discrepancies. In the meantime the question remains open as to whether the disease is directly contagious, whether a biting fly is a necessary factor in its transmission, or whether it may be conveyed in more than one way.

Whether the conclusion shall be finally justified that the disease is directly contagious, the work reported from the Swedish Medical Institute establishes one highly important fact, namely, that the infection of poliomyelitis is more common, probably much more common, during an epidemic than the occurrence of clinically recognizable cases; that the virus may be and apparently often is harbored in the human body without the production of clinical effects. Granting this, the epidemiologic observations made in Massachusetts, the only place in this country where such observations have been systematically continued over a period of several years, appear to be quite in harmony with the idea that the *Stomoxys* is an important or even necessary factor in the transmission of poliomyelitis.